POWER PLAY

Shaping and stabilizing the plasma in a magnetic fusion device is done by changing the currents in the magnetic field coils. Control over these currents required the development of systems capable of handling large amounts of power. Lightweight, compact, and reliable power conversion units have been developed for the fusion program and marketed for applications in defense and transportation.

Technology developed in the fusion program to maintain a stable plasma configuration can be used for efficiently transforming power from ac or dc sources into high currents under accurate control.

High-current electronic valves that used silicon-controlled rectifier (SCR) switches were developed and used to transform and control more than 100 MW of power in the mag netic field coils of the DIII-D tokamak, thus shaping and stabilizing the fusion plasma. A control system based on these switches was also provided to the Massachusetts Institute of Technology and used for plasma stabilization and control on the Alcator-C tokamak.

As gate turn-off (GTO) thyristor technology advanced, the power con version units (PCUs) were improved by replacing the SCRs with GTO thy ristors, resulting in more compact, more reliable, integrated units used in the system at left.

The compatibility of PCUs with battery power sources, combined with their attractive weight and size and high reliability, recently led to their incorporation into a conceptual design for a quieter torpedo launcher for the Navy. In this concept, the combination of PCUs and a linear motor replaces the compressed-air-driven water pump now used to launch torpedoes.

The PCU–linear motor combina tion is also at the heart of ongoing